Multiple Air Toxics Exposure Study (MATES IV)

UFP and BC Measurements

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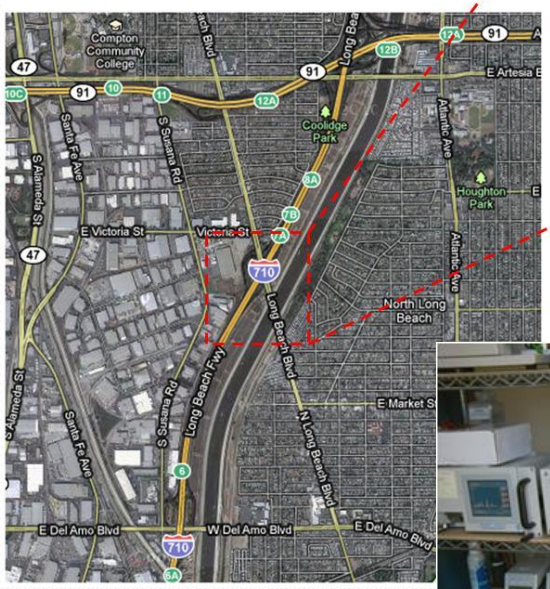
Andrea Polidori, Ph.D
Quality Assurance Manager
South Coast Air Quality Management District

apolidori@aqmd.gov

Pre-MATES IV Instrument Evaluation (Ultrafine PM)



- Water-based Condensation Particle Counters (CPCs)
  - ➢TSI models 3781, 3783, and 3785 (three units per model)
  - ➢CPCs from other manufacturers also tested
- Size distribution (SMPSs)
- Meteo data
- Traffic information

Specifications	Model 3781	Model 3783	Model 3785
Detectable Particle Diameter Ranges	6 nm to 3 µm	7 nm to 3 µm	5 nm to 3 µm
Time Resolution	1 min	1 min	1 min
Maximum Detectable Particle Concentrations (cm^{-3})	5×10^5	1×10^6	1×10^7
Particle Counting Errors	± 10 % at 5×10^5 cm^{-3}	± 10 % at 1×10^6 cm^{-3}	± 10 % at 2×10^4 cm^{-3}
Aerosol Flow Rates (L/min)	0.12 ± 0.012	0.12 ± 0.012	1.0 ± 0.1
Inlet Flow Rates (L/min)	0.6 ± 0.12	3 ± 0.3	1.035

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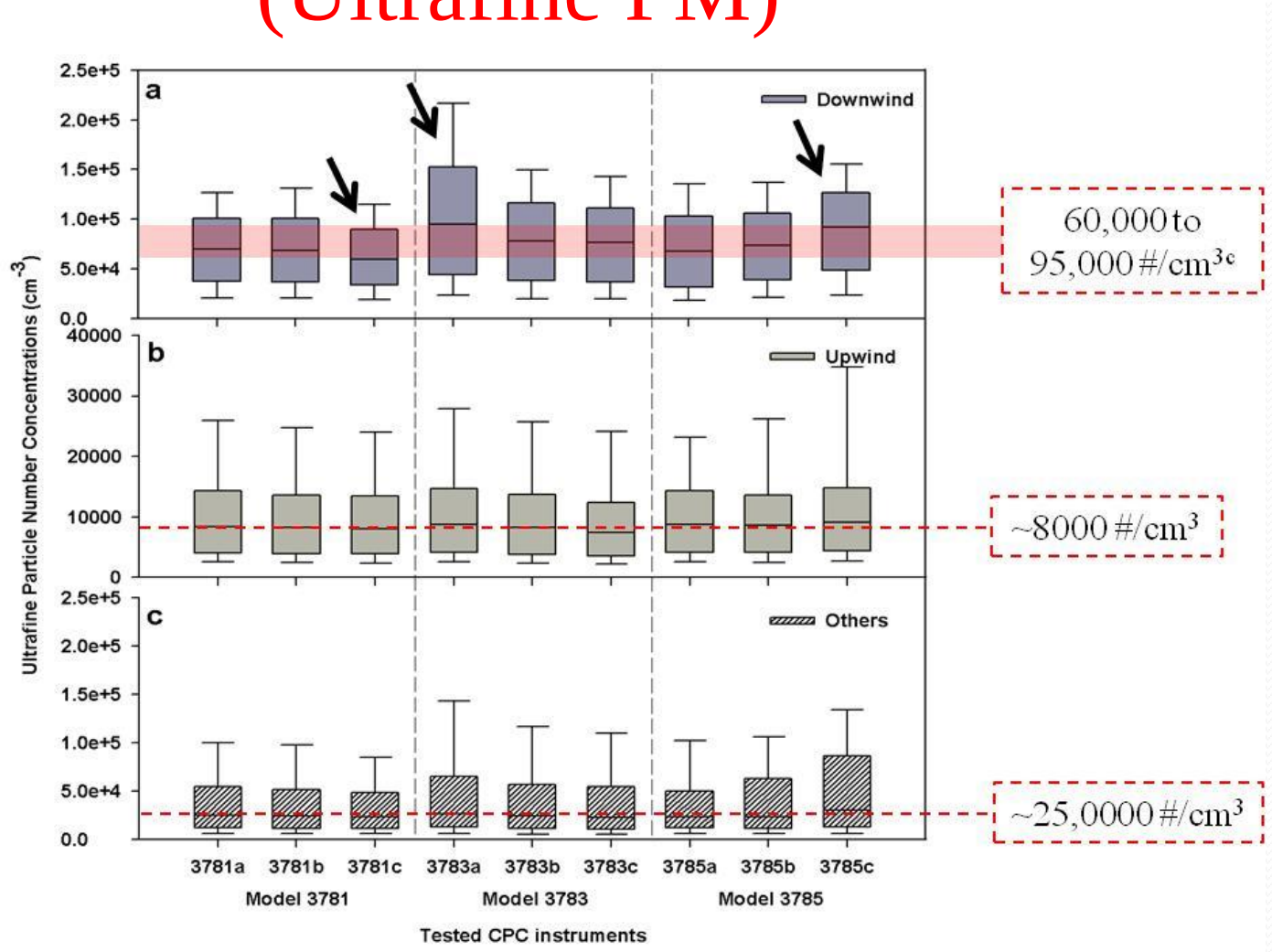
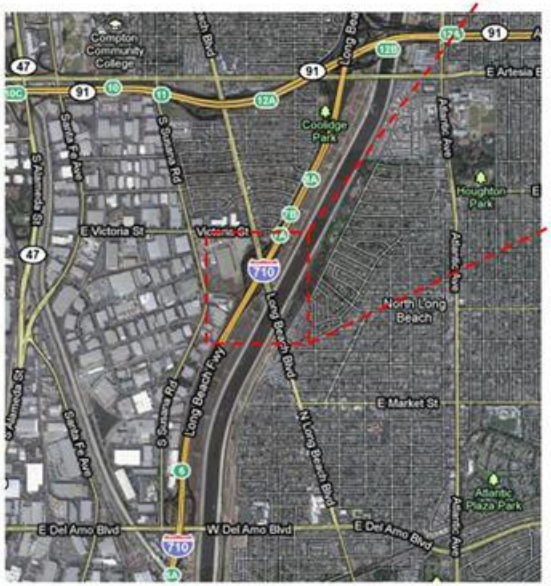


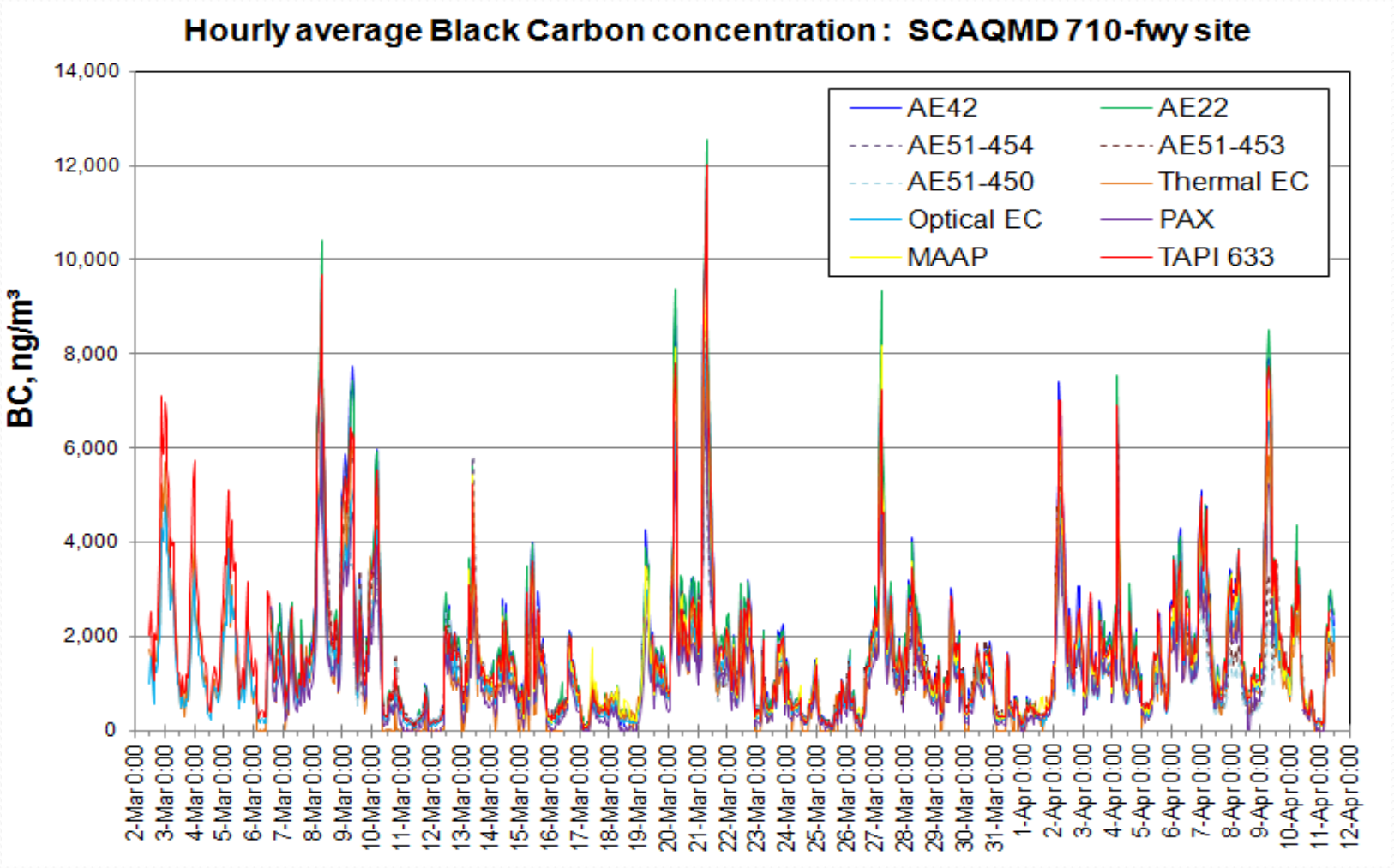
Lee, E. et al. (2013) "Water-based condensation particle counters comparison near a major freeway with significant heavy-duty diesel traffic", Atmospheric Environment, 68: 151-161

Pre-MATES IV Instrument Evaluation (BC and EC)



- Athelometer: http://mageesci.com/
  - Dual-channel
  - Portable
  - Micro
- Photoacoustic Extinctiometer (PAX): http://www.dropletmeasurement.com/products/carbon-sensing-instruments.html
- Semi-continuous carbon analyzer: http://www.sunlab.com/
- Multiangle Absorption Photometer (MAAP): http://www.mlu.at/index.php?gr_id=66&k_id=506&b_id=&gp=&at=238
- Integrated filter samples for EC

Pre-MATES IV Instrument Evaluation (BC and EC)



Pre-MATES IV Instrument Evaluation (BC and EC)

- Both measurements are operationally defined
- Very strong correlation - slopes can be adjusted

Correlation Coefficient (R^2)

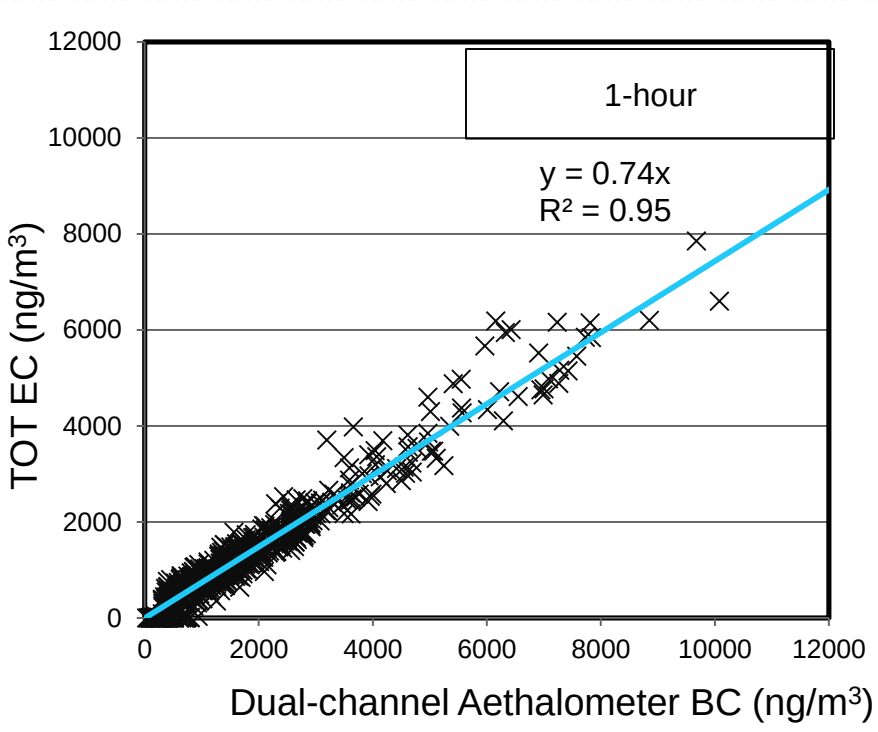
	Legacy Aeths	Thermal EC	Optical EC	PAX	MAAP
633	0.99	0.95	0.96	0.98	0.98
Legacy Aeths		0.95	0.98	0.98	0.99
Thermal EC			0.94	0.95	0.95
Optical EC				0.96	0.98
PAX					0.97

^ X ^

Slope

	633	Legacy Aeths	Thermal EC	Optical EC	PAX	MAAP
633		1.08	0.80	0.79	0.70	0.93
Legacy Aeths	0.93		0.75	0.76	0.66	0.87
Thermal EC	1.26	1.34		1.04	0.92	1.28
Optical EC	1.26	1.32	0.96		0.89	1.13
PAX	1.43	1.52	1.09	1.13		1.35
MAAP	1.07	1.15	0.78	0.89	0.74	

^ X ^



Long-term Monitoring

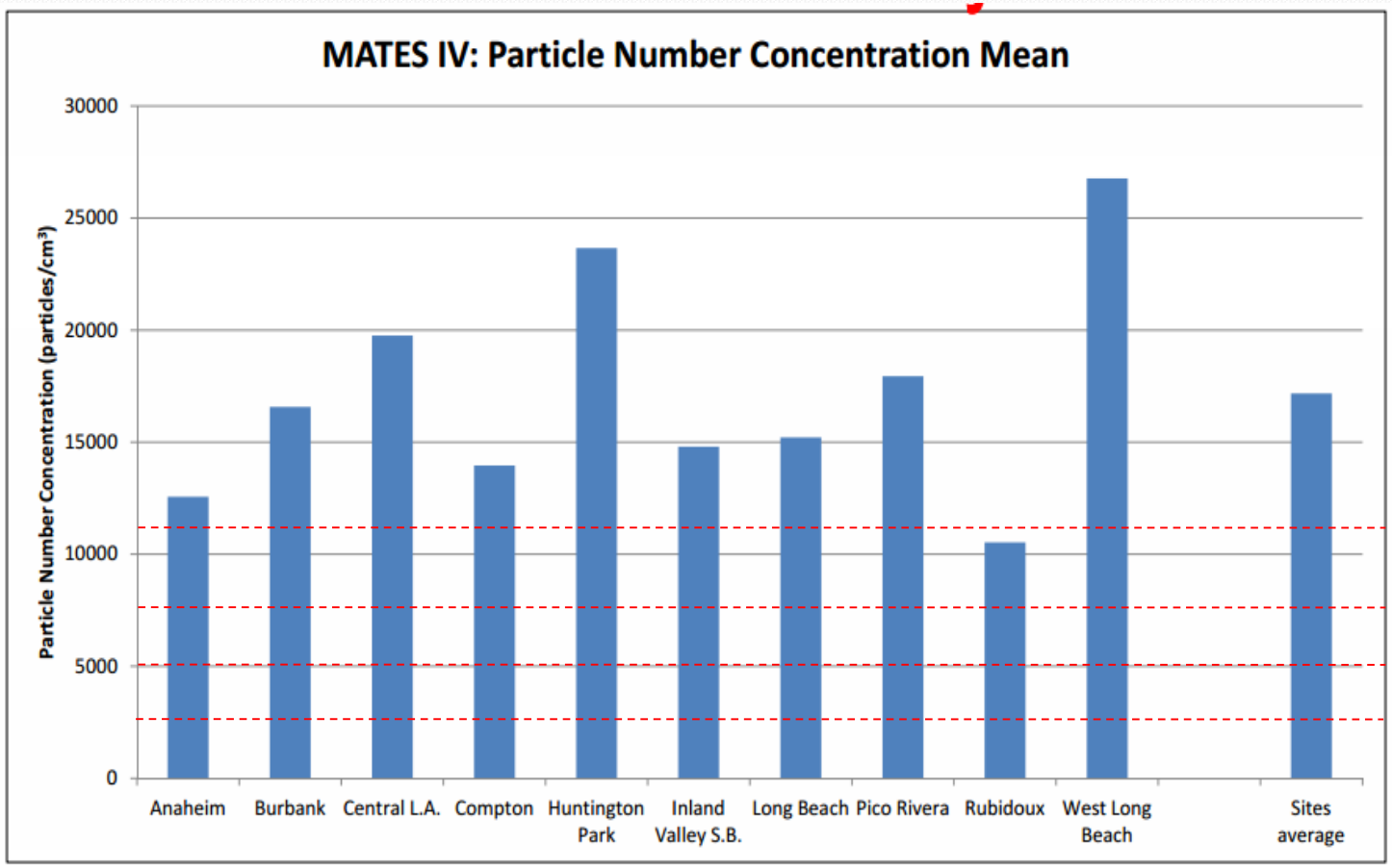
- Continuation of MATES III methods for trend analysis
  - 10 sites, 1-in-6 day, 24-hr integrated sampling, continuous monitoring
  - Utilize ongoing toxics monitoring programs
  - Duration: 07/01/2012 – 07/01/2013
  - Measured species: VOCs, Carbonyls, TSP metals, $Cr^{6+,}$ Lead, $PM_{2.5}$ speciation (metals, EC, OC), BC, ultrafine PM

Long Term Monitoring: Ultrafine PM by Site

Road Side (~50,000 #/cm^3)

On-road (~70,000 #/cm^3)

Tunnel (~170,000 #/cm^3)



Reference UFP levels are from 2012 AQMP (Chapter 9)

Urban

Urban Background

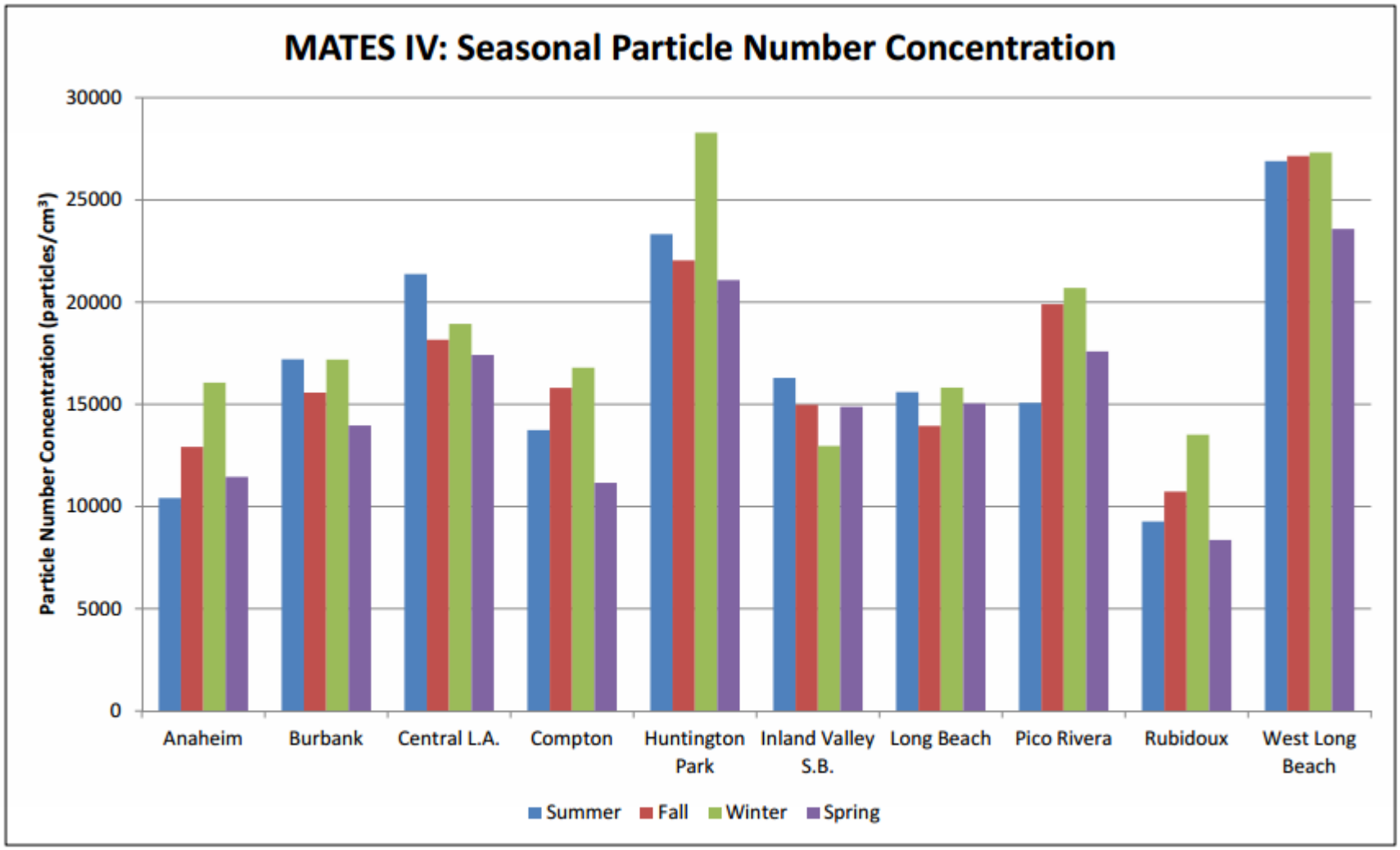
Rural

Clean Background

Preliminary MATES IV data

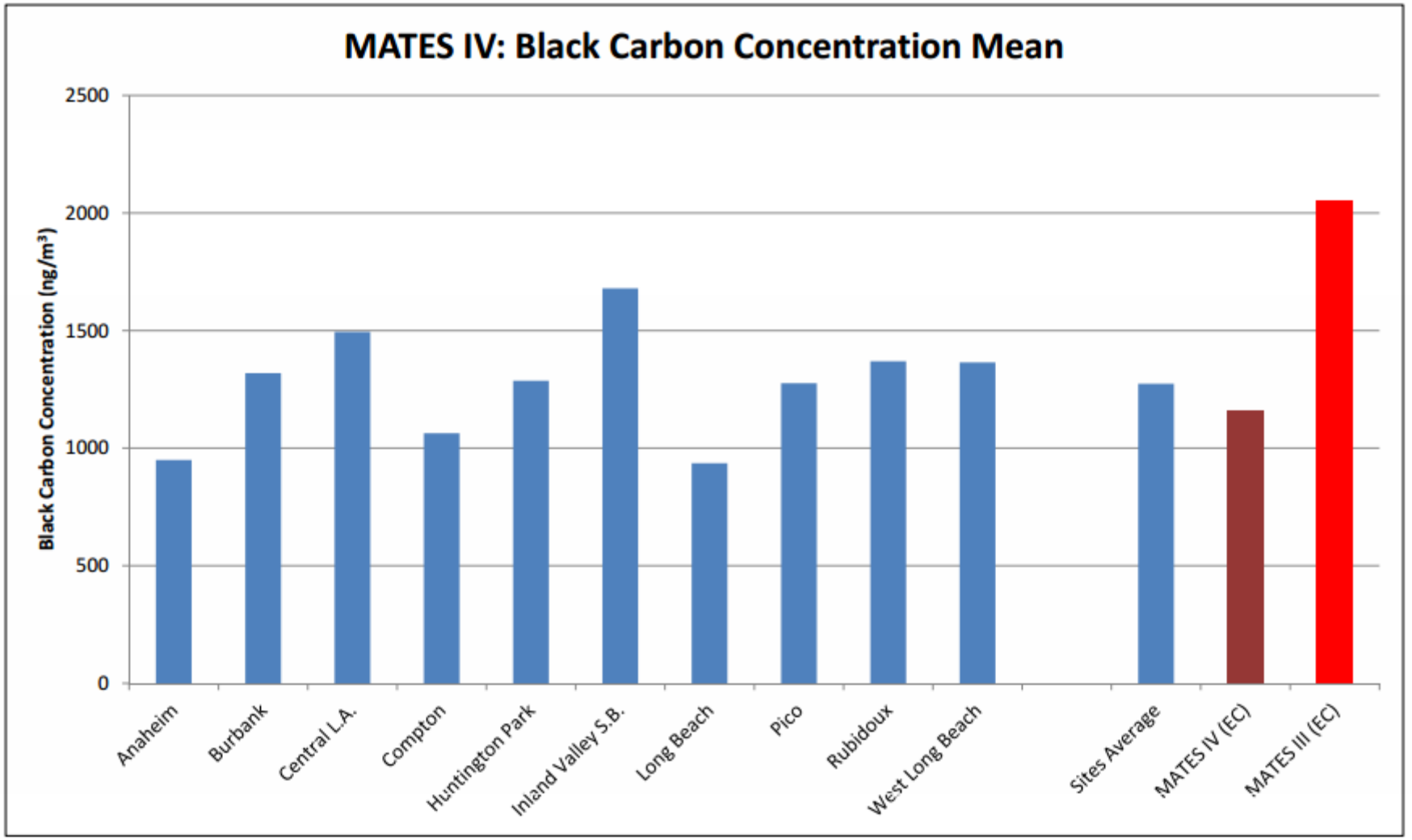
- Wide spatial variability

Long Term Monitoring: Ultrafine PM by Season



Preliminary MATES IV data

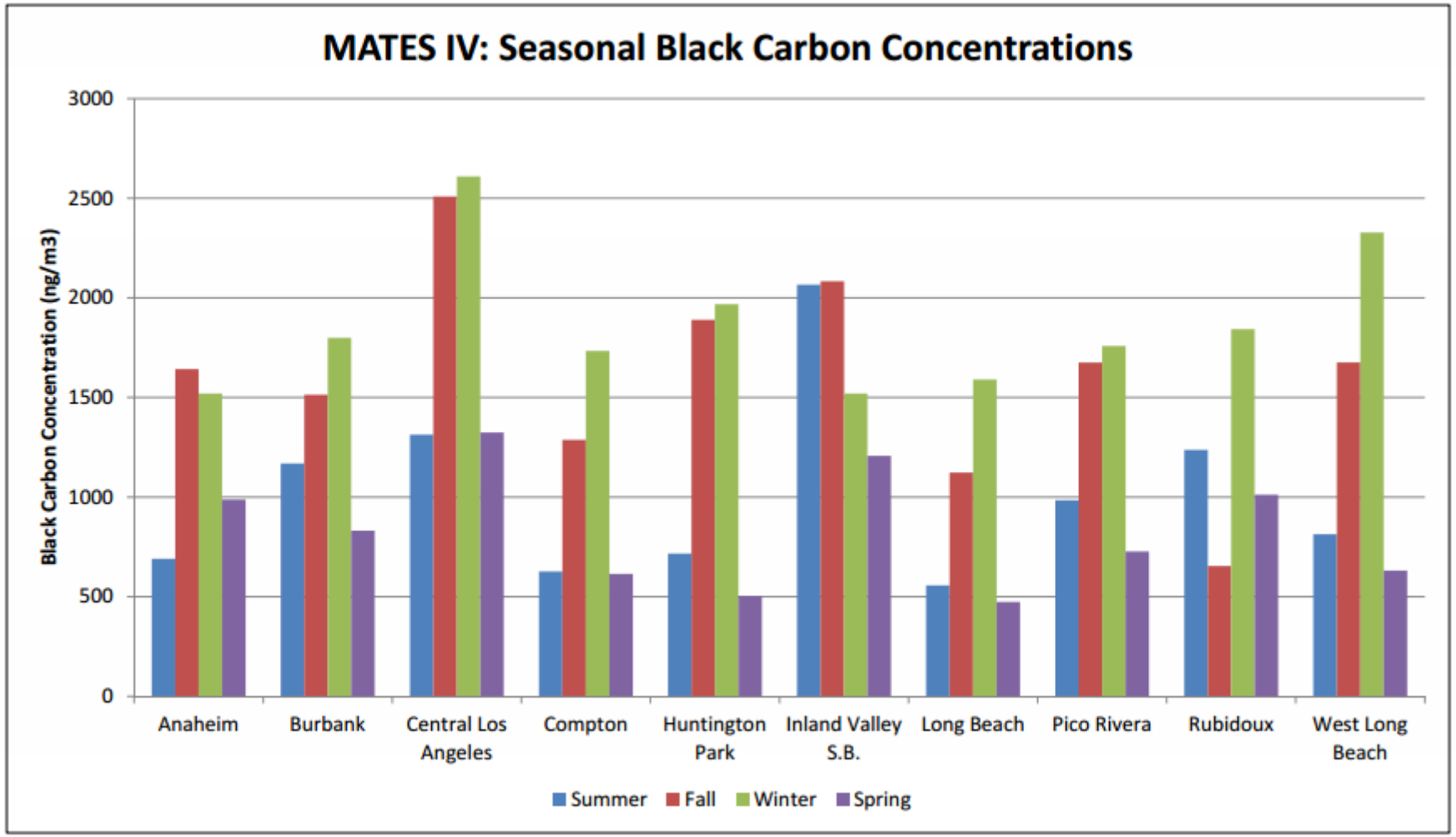
Long Term Monitoring: BC by Site



Preliminary MATES IV data

- Different spatial profile than UFP

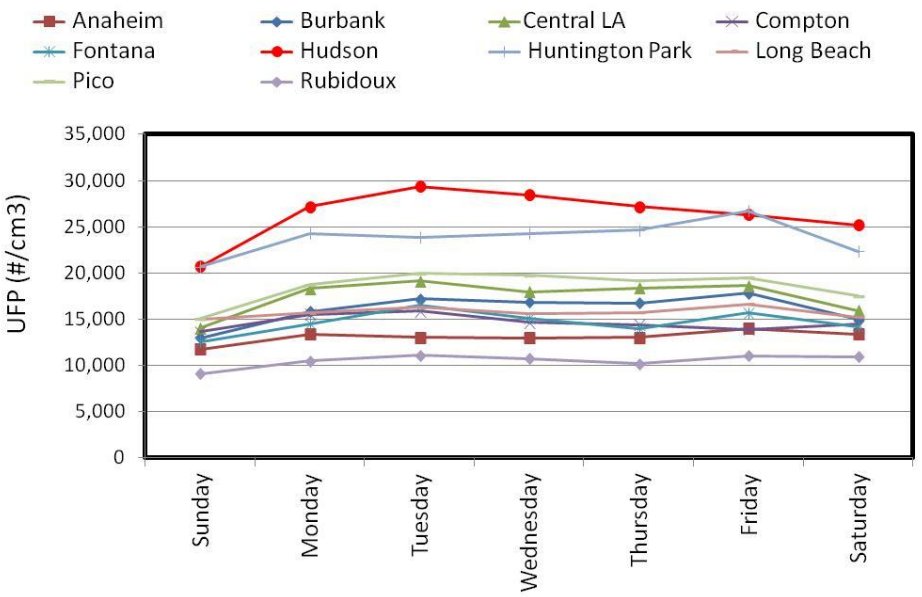
Long Term Monitoring: BC by Season

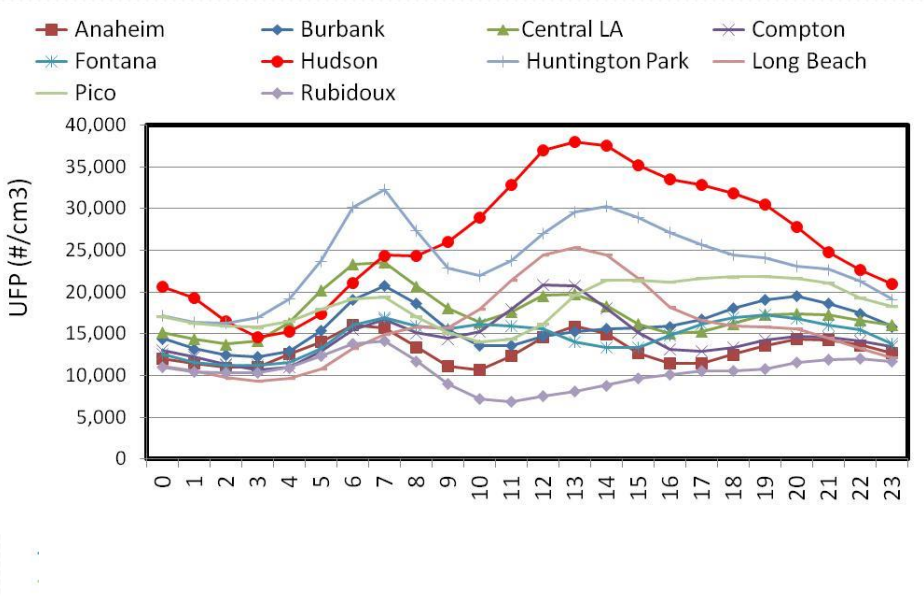


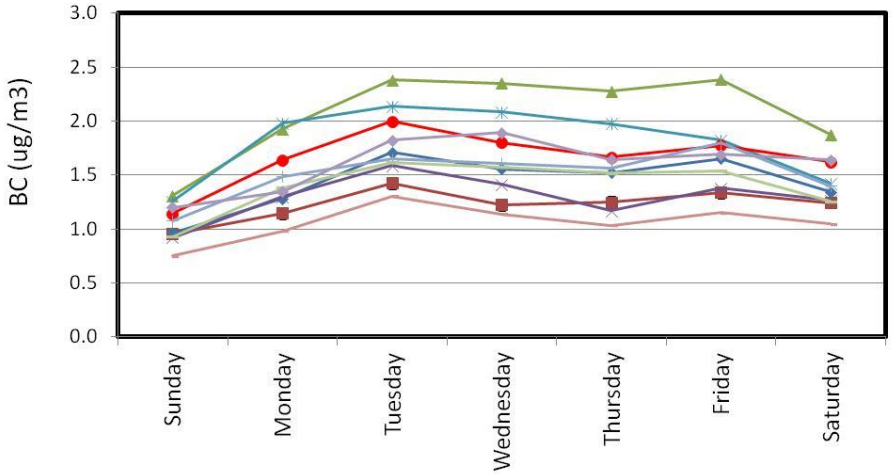
Preliminary MATES IV data

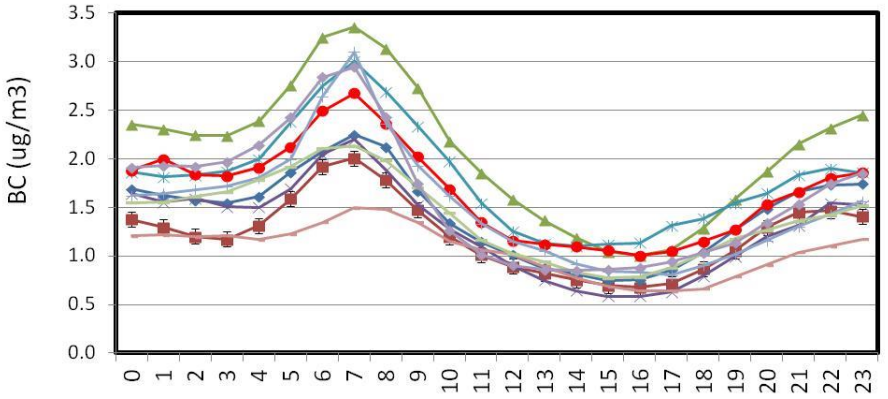
- Different seasonal profile than UFP

Long Term Monitoring
Day of the Week & Time of the Day





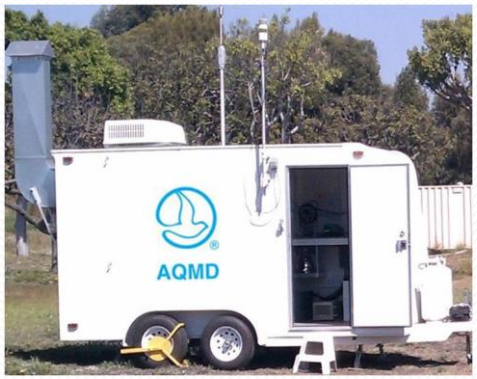




Preliminary MATES IV data

Short-term / Local-scale Monitoring

- Mobile source impacts: Ultrafine & Diesel PM
- Mobile monitoring platforms and multiple fixed sites to measure micro-scale gradients
- Short-term deployment (e.g. days to weeks)
- Locations (6-8 total)
  - Freeways (*e.g. I-710, CA-110, CA-103*)
  - Airports (*e.g. LAX and Long Beach*)
  - Intersections/Warehouses (*e.g. Mira Loma*)
  - Rail yards (*e.g. San Bernardino*)
  - Communities (*e.g. Boyle Heights*)

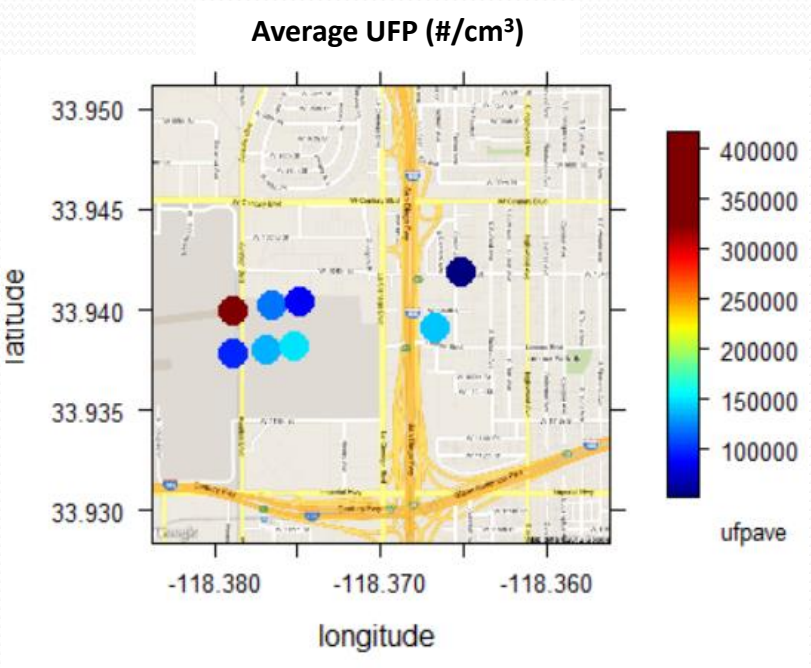


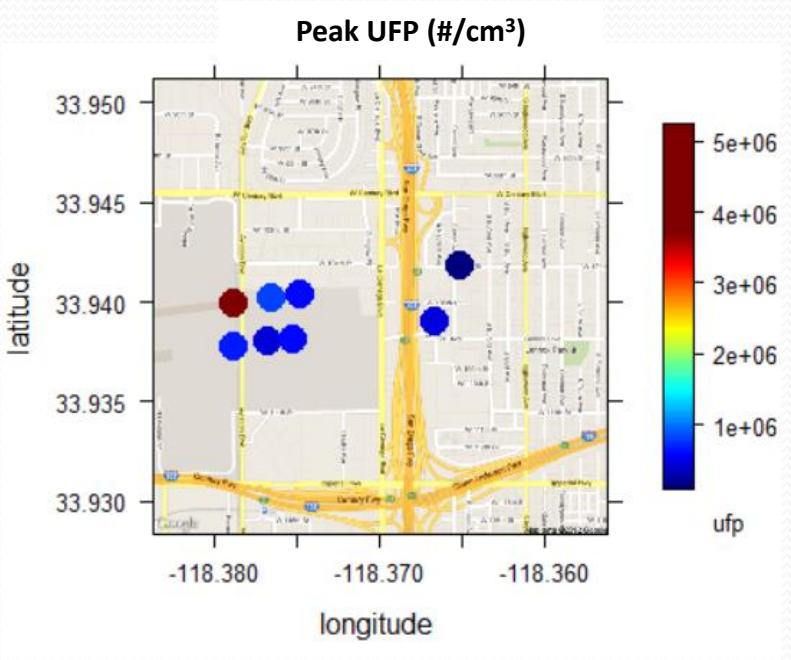
Short-term Monitoring: LAX (Gradient Study)

Preliminary MATES IV data

Short-term Monitoring: LAX (Gradient Study)

- UFP levels peaked next to runway 25 R (take-off) and decreased away from the airport
- Max 1-min UFP concentration ~5,250,000 #/cm^3

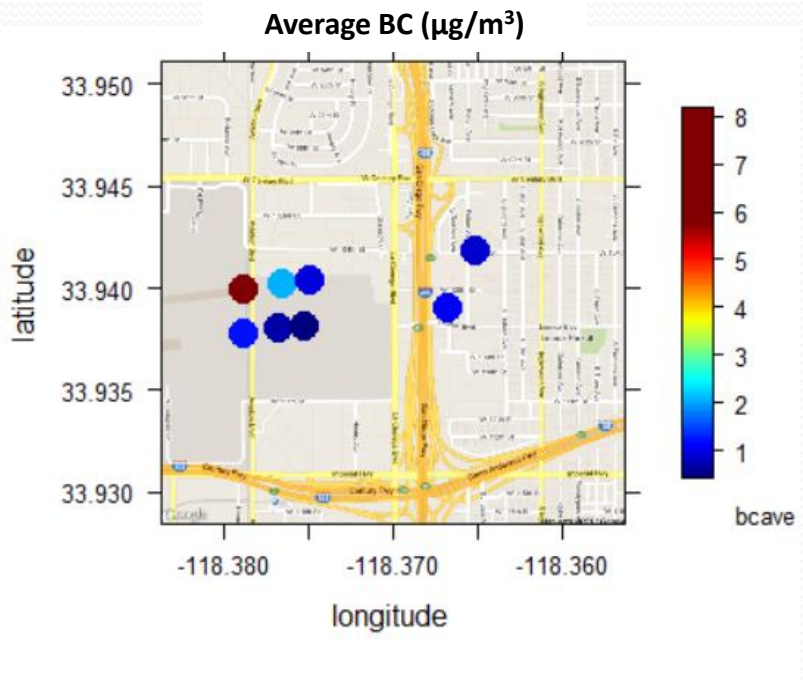




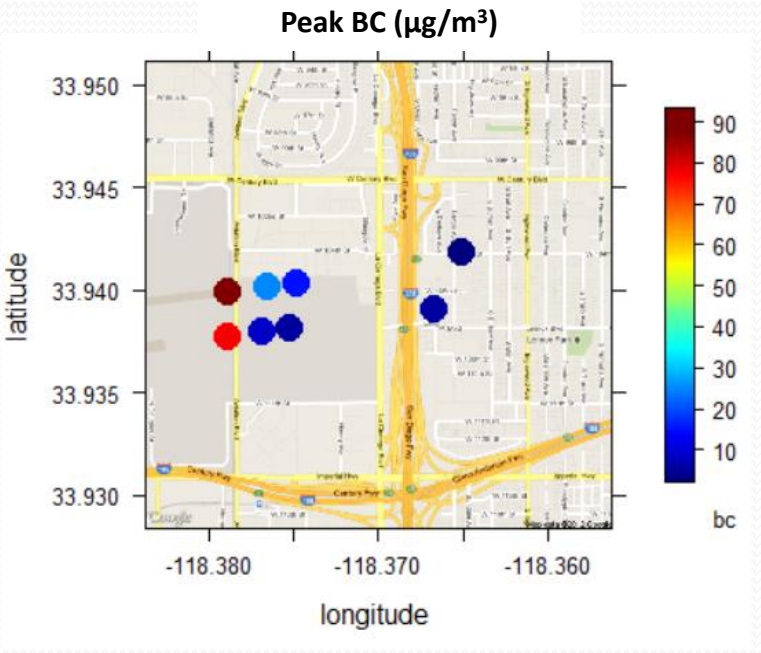
- UFP concentrations slightly higher away from runway 25 L (landing?)
- UFP concentrations decreased away (downwind) of the I-405

Short-term Monitoring: LAX (Gradient Study)

- BC levels peaked next to runway 25 R (take off) and decreased away from the airport
- Max1-min BC concentration ~93 µg/m^3

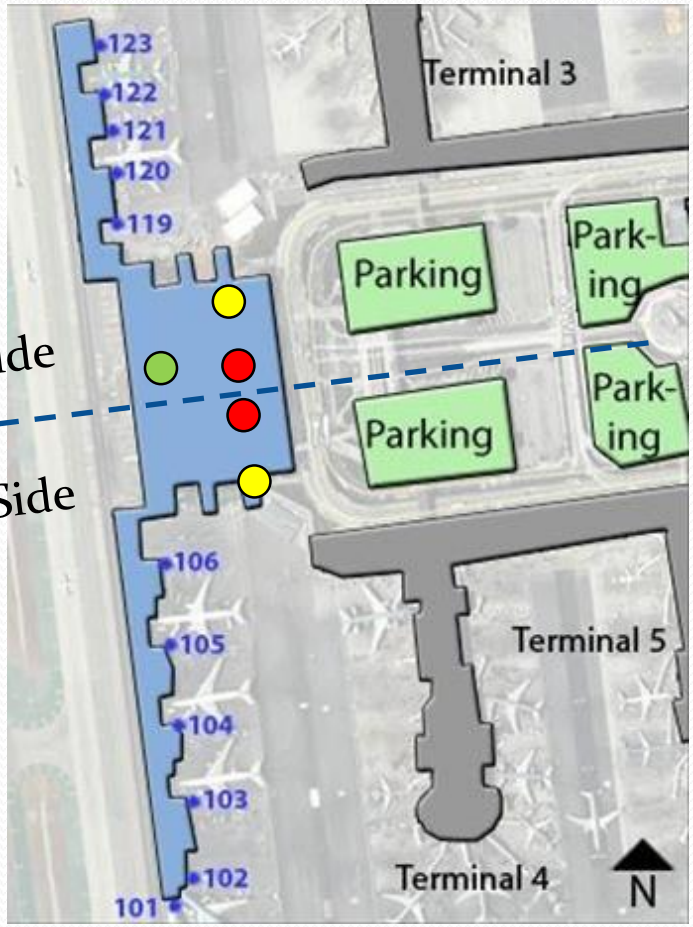


- BC concentrations lower away from runway 25 L



- Relatively low BC concentrations east (downwind) of the I-405 (low diesel traffic flow)

Short-term Monitoring: LAX (Tom Bradley International Terminal)



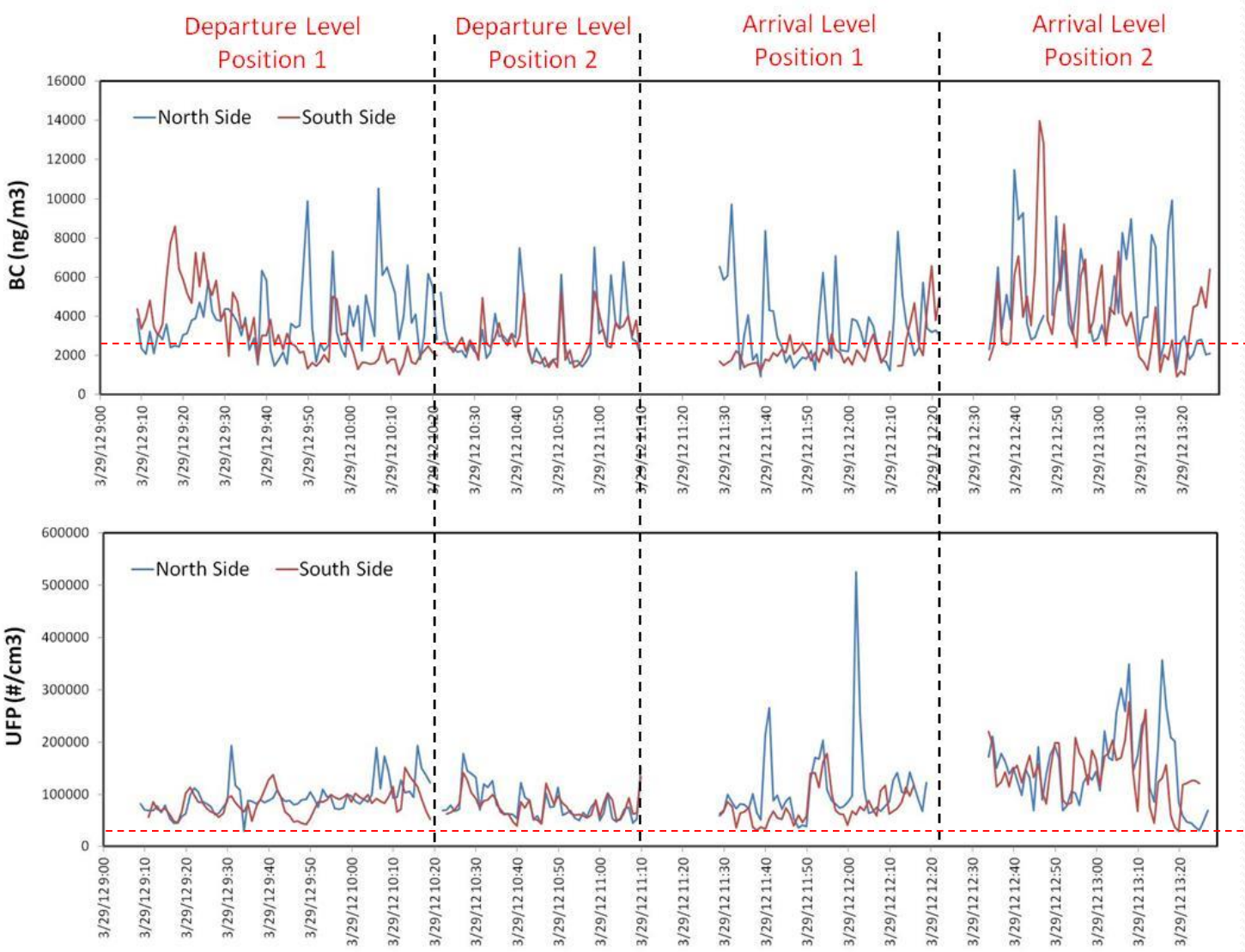
North Side

South Side

Position 1 (outdoors) Position 2 (outdoors) Indoors

Preliminary MATES IV data

Short-term Monitoring: LAX (Tom Bradley International Terminal)



Central LA (03/29/12)
2,360 ng/m3

Hudson (03/29/12)
28,310 #/cm3

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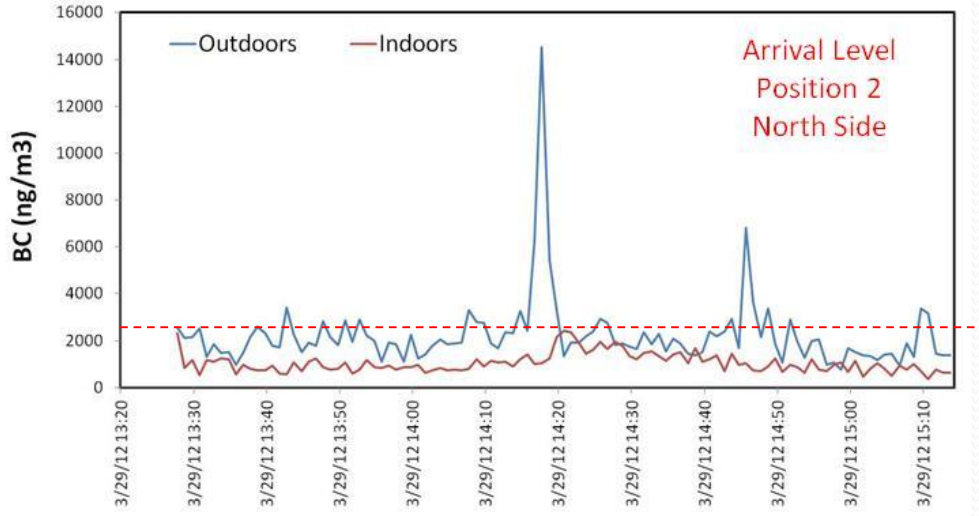

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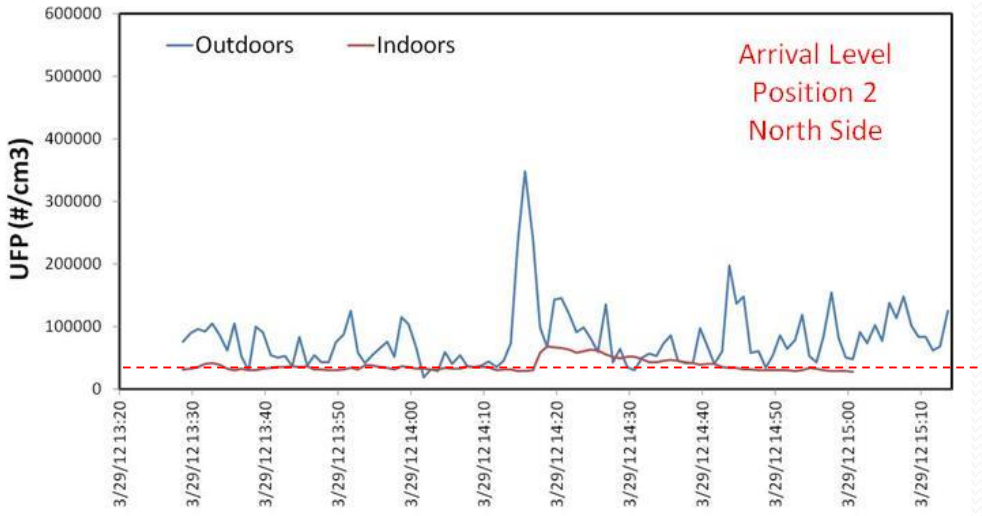

Hudson (03/29/12)
28,310 #/cm3

QUESTIONS?

Jean Ospital - Health Effects Officer
(jospital@aqmd.gov; 909-396-2582)

Andrea Polidori - QA Manager
(apolidori@aqmd.gov; 909-396-3283)